RULES FOR FORECASTING THE CREST STAGES AT VICKSBURG, MISS., BASED UPON THE STAGES AT CAIRO, ILL.

By HERMAN W. SMITH.

Vicksburg is 602 miles below Cairo. The velocity of the current at a 25-foot stage is about 3 miles per hour and at a 45-foot stage it is about 4.7 miles per hour. This would give the time for stream flow from Cairo to Vicksburg as 6 days for high stage and about 8 days when the river is at 25 feet.

Figure 1 gives the time intervals for the travel of the crest stages from Cairo to Vicksburg for a large number of crests from 30 to 55 feet at Cairo. It will be seen that the time interval of the crests between the two places does not decrease with the higher velocity of stream flow at higher stages, but the higher the flood crest, the longer it takes for it to reach the lower station. This is probably due to the damming effect of the overflowing of the river banks. The average time for a crest of 30 feet to travel from Cairo to Vicksburg is 8 days, and for a crest of 50 feet, 20 days.

The character of the rise has a marked effect on the time interval for the crest. When the rise is rapid at
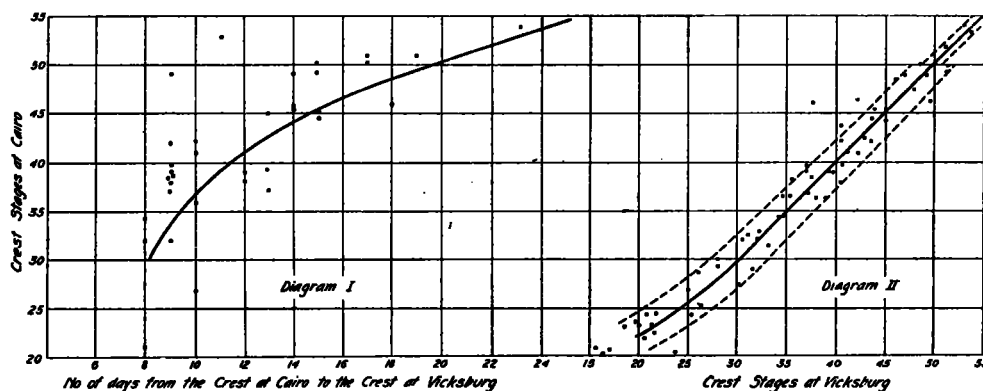
Figs. 1 and 2.—Gage relations, Cairo and Vicksburg—time at left, crest at right.

Cairo and then falls rapidly, the crest will reach Vicksburg from 2 to 8 days sooner than when the rise is long sustained at Cairo after the crest has reached that place. The higher the crest the longer the crest will be delayed.

Figure 2 shows the relative height of the crest stages, Cairo and Vicksburg.

Above 30 feet the average crests are about the same at the two places, but there is a range of about 2 feet on either side of the mean for stages below 50 feet.

When the river falls rapidly at Cairo after the crest reaches that place, the crest stage at Vicksburg will be lower than at Cairo, generally from a few tenths to a foot, but it may be as much as 2 feet when the crest is below 50 feet.

When the streams below Cairo are high and deliver their crests in time to meet the crest from Cairo it will increase the crest stage at Vicksburg, sometimes by as much as a foot or two.

When the rise at Cairo is long sustained and the Mississippi is high above Cairo, the crest stage at Vicksburg will frequently be from a few tenths to as much as a foot higher than at Cairo. With a crest stage below 50 feet the difference may sometimes be as much as 2 feet, if the tributary streams below the Ohio are high.

FLOOD PREVENTION IN THE MINNESOTA VALLEY.

Some of the conclusions reached by Mr. Meyer are as follows:

(1) Material reduction of devastating floods in the Minnesota River Valley is possible, but some lands must be sacrificed for the benefit of others.

(2) No substantial protection can be accomplished by either levee construction or channel improvement.

(3) Flood protection must and can be accomplished by reservoir construction.

(4) Protection of the valley lands from all floods, including those extraordinary ones of rare occurrence is not worth what it would cost.

(5) The protection of most of the valley lands from frequent flooding is possible and worth more than twice what it will cost.

(6) The best paying project is that which protects the valley lands from all floods except those which may be expected to recur, on an average, once in 10 or 15 years.

(7) Automatic retarding basins are not practicable on the Minnesota River. Manually controlled reservoirs must be used.

(8) No satisfactory reservoir sites are available, on the tributary streams.

(9) Three large reservoirs with a total capacity of eighteen and one-half billion cubic feet can economically be secured for flood prevention purposes in the valley itself.

(10) Although the reservoirs proposed can not retard all the run-off water during extreme floods, the structures themselves must be able to safely meet extreme flood conditions.

(11) Practically all lowlands in the Minnesota River Valley, aggregating about 100,000 acres, are now flooded at least every other year on an average.

(12) The flood protection works proposed will materially benefit over 60,000 acres. Large additional areas will receive minor benefits. This does not include prairie lands to which the valley furnishes ditch outlets.

(13) About 20,000 acres of agricultural lands lying within the reservoirs will be depreciated because they will be flooded more frequently than at present. (This area does not include areas classified as lakes, ponds, sloughs, or marshes on the Government maps based on the surveys of 1909–10.)

(14) On the basis of the available data the cost of the proposed project is estimated at nearly $2,000,000.

(15) Minnesota needs to appropriate funds for topographical surveys and hydrological observations.

(16) All three reservoirs here proposed must be planned and operated as a single system or full benefit will not be derived therefrom.

(17) The reservoirs proposed are for flood prevention purposes and not for power or navigation. They must be operated as intended in order to be effective.

[1] Bulletin of the Affiliated Engineering Societies of Minnesota, December, 1920.